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(54) IMPROVEMENTS IN WINDOW ASSEMBLIES

(71) We IMPERIAL CHEMICAL INDUSTRIES LIMITED, of Imperial Chemical House, Millbank, London S.W.1., a British Company do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to double glazing systems, and particularly to assemblies for the conversion of windows from single glazing to double glazing or a single window to a double window.

With the use of efficient heating systems in buildings a demand for the insulation of the buildings against heat loss to the outside surroundings has arisen. One contribution to the thermal insulation is the provision of double glazing systems for the windows. Double glazing systems also serve as acoustic barriers against the ingress of noise from external surroundings into buildings. In many existing buildings the expense in replacing the original single-glazed window frames with new double-glazed frames prohibits all but the wealthy from effecting such a conversion. However, an alternative to the replacement of the entire window frame is to attach a second sheet of glazing material to the window frame over the original sheet.

According to one aspect of the present invention, an assembly for the conversion of a single-glazed window to double glazing or a single window to a double window, comprises an edge strip and a sheet of glazing material, said edge strip having a base web and a flange extending substantially perpendicular out of and longitudinally along the base web, at least one marginal portion of the sheet of glazing material being bonded to said flange and web.

According to another aspect of the present invention, the assembly has a further flange spaced apart from the first flange and parallel thereto extending substantially perpendicular

ly out of and longitudinally along the base web, the marginal portion of the sheet of glazing material being bonded into the space between the two flanges or to the web and outer surface of one of the flanges.

The edge strip may be positioned around all or only around some of the edges of the assembly.

The assembly may be affixed over the glazing material of a fixed or opening window frame, generally by affixing the assembly to the frame carrying the glazing material. This provides a sealed space between the existing glazing in the window frame and the sheet of glazing material of the converting assembly which serves as a double glazing and possibly also as an acoustic unit.

Alternatively the converting assembly may be affixed to the fixed frame, in which an opening window frame is mounted, thereby not only providing a sealed space between the existing glazing in the opening frame and the sheet of glazing material of the converting assembly to act as a double glazing and/or acoustic unit but also serving to seal the window unit against the ingress of draughts between the fixed and opening frames. For optimum effect the converting assembly should be efficiently sealed against the fixed frame.

As a modification of the system discussed in the last preceding paragraph the converting assembly may be attached to the window surround, i.e. the plaster or brickwork defining the window aperture and surrounding the window frame mounted therein. A mounting strip may be provided in the surround for mounting the converting assembly upon. This mounting strip may be a metal or plastics extrusion. This construction also provides a seal against the ingress of draughts.

The assembly may be permanently attached to the window frame in constructions where it would not impede the movement of an opening frame, e.g. it may be

affixed to an opening frame itself or to a fixed frame not involving an opening window, to form a sealed space between the existing glazing in the window and the sheet of glazing material of the converting assembly. Alternatively the converting assembly may be affixed to the window frame so that it is detachable or so that all of the sides of the assembly except for one side can be released from the frame, the remaining side being hinged to the frame, thereby enabling the inner surfaces of the existing glazing in the frame and the glazing material of the assembly, i.e. the surfaces of the existing glazing and the glazing material confronting the space therebetween, to be cleaned by pivoting the assembly away from the frame. Also in the case where the converting assembly is affixed to the fixed frame in which an opening frame is mounted, the assembly may be pivoted away from the fixed frame to enable the opening frame to be opened in the normal way thereby providing for ventilation through the system.

Preferably a hinge made, for example of metal or a plastics material, is secured to the edge strip along one side of the assembly by bonding, screwing or riveting. The hinge is attached to one side of the frame whilst the remaining sides of the assembly are secured to the other sides of the frame by means of readily releasable clips, which may be snap clips, e.g. consisting of moulded plastics material such as nylon, or clips which may be mechanically adjusted into engagement with the frame or members attached to the frame. It is possible to use clips of a more permanent nature than snap clips and adjustable clips, e.g. clips which may be screwed or bolted to the frame. However, clips of this nature require more tedious manipulation than do the more readily releasable clips in order to release the assembly from the frame. Therefore, we prefer to use readily releasable clips. The edge strip may be formed with a peripheral ridge protruding out of the base web, the clips being arranged to engage the ridge. If desirable a continuous bead may be clamped over the ridge and drawn into engagement with it by the clips.

One embodiment employs hinges along two opposite sides of the converting assembly, one part of each hinge being attached to the edge strip, e.g. by riveting, and the other part being attached to the window frame, e.g. by screwing. The two parts of the hinge are held together by a pivot pin which may be withdrawn to separate the two parts. To pivot the converting assembly away from the window frame the pins are withdrawn from the hinges along one side of the converting assembly so that the assembly can be swung away from the window frame whilst pivoting about the hinges along the opposite side. By using

hinges in which the pivot pins can be withdrawn the hinge can serve to provide a true hinging function between the converting assembly and the window frame and also as a releasable clip when the pivot pin is removed. It will be appreciated that the dual functions of the hinges enables a converting assembly hung on these hinges to be pivoted about any one of its sides chosen at will or to be removed from the window frame altogether by removing the pivot pins from every hinge.

In an alternative embodiment, an edge bead is constructed so that it may perform two functions in securing the assembly to the frame by engaging the edge of the assembly or the edge strip; firstly it is formed to serve as a hinge, and secondly it is formed so that it may be separated into two parts. Accordingly, such an edge bead may be arranged around the whole periphery of the assembly with the advantage that the assembly may be hinged away from the frame about the edge bead attached to any one side of the assembly after the edge bead along each of the other sides has been separated into two parts.

In order that the space between the existing glazing and the glazing material of the assembly according to the invention may be efficiently enclosed a sealing strip is preferably attached around the whole periphery of the assembly. When the edge strip extends around all of the edges of the assembly the sealing strip may be attached to the edge strip. The sealing strip should be attached to the assembly so that it faces the window frame and will be compressed to prevent the passage of air between itself and the frame or surround when the assembly is clipped on to the frame or surround. Suitable materials from which the sealing strip may be made include foamed plastics materials, rubbers or foamed rubbers, such as polymers based on chloroprene, e.g. "Neoprene" and the woven fabric piles. The sealing strip may be secured in place by any suitable adhesive, such as natural rubbers or synthetic rubbers, e.g. butadiene or chloroprene based rubbers in solvents such as chlorinated hydrocarbons or petroleum ethers, and epoxy resins.

The edge strip may be made of any suitable material, e.g. metals, such as aluminium or stainless steel, and synthetic plastics materials, such as glass reinforced polyester, nylon or glass reinforced nylon, vinyl chloride polymers, polyacetal and polymethyl methacrylate. We prefer to use extruded aluminium sections as the edge strip.

The sheet of glazing material may comprise glass or a transparent or translucent plastics material, such as polymethyl methacrylate or a vinyl chloride polymer.

Any suitable adhesive material may be chosen to bond the glazing material to the

edge strip. The adhesive material must be capable of adhering to the materials from which the edge strip and the glazing sheet are made. Suitable adhesive materials include polyvinyl butyral, polysulphides, polyacetals and epoxy resins. Preferably the adhesive material is a copolymer of ethylene with one or more hydroxy or epoxy lower aliphatic monoesters of acrylic acid or methacrylic acid, and with from 0% to 55% by weight of at least one further comonomer, which may be an ester of acrylic or methacrylic acid or a vinyl ester or another copolymerisable compound, said copolymer containing, by weight, at least 35% of ethylene and:

- (a) from 1.0% to 8.5% of free hydroxy groups; or
- (b) from 0.10% to 3.0% of epoxy oxygen; or
- (c) both free hydroxy groups up to 9.5% and epoxy oxygen up to 3.0% provided that: weight of free hydroxy groups + (10 × weight of epoxy oxygen) is always at least 1, by weight of the copolymer.

The hydroxy or epoxy lower aliphatic radical of the ester, which may be a straight chain, branched chain or cyclic aliphatic radical, preferably contains from 2 to 6 carbon atoms, and is preferably a hydroxy or epoxy alkyl or hydroxy or epoxy cycloalkyl radical. It may, however, contain ether linkages, and it may contain one or more hydroxy or epoxy groups. The ester is preferably a hydroxy ester, and the hydroxy alkyl esters of acrylic and methacrylic acid are particularly preferred.

The further comonomer or comonomers may be chosen from vinyl acetate or an alkyl ester of acrylic or methacrylic acid, particularly methyl methacrylate. Further compounds from which the said further comonomer or comonomers may be selected include vinyl aromatic and vinyl heterocyclic compounds, such as, for example, styrene, vinyl naphthalene, N-vinyl carbazole, N-vinyl phthalimide; and acrylonitril and the N-phenyl maleimides. The vinyl aromatic and vinyl heterocyclic comonomers may contain substituents additional to the vinyl group, such as alkyl or alkoxy groups, provided they do not occupy positions where they would inhibit the copolymerising activity of the vinyl group.

Generally copolymers containing from 1.5% to 6.0% by weight of free hydroxy groups and/or from 0.3% to 1.0% by weight of epoxy oxygen are preferred.

The preferred copolymers include hydroxyethyl acrylate and hydroxyethyl methacrylate copolymers, especially the latter. Copolymers containing from 13% to 40% by weight of hydroxyethyl methacrylate (1.70% to 5.23% free hydroxy groups), the remainder being, essentially, ethylene, are especially suitable.

Terpolymers having the composition by weight:

ethylene	77.5%	73.0%
hydroxy ethyl methacrylate	14.5% or 23.0%	
methyl methacrylate	8.0%	4.0%

have been found to be particularly suitable as adhesive materials for the production of double glazing laminates.

Other copolymers which are useful include copolymers described of ethylene with, for example, glycidyl acrylate or methacrylate, glycerol monoacrylate or monomethacrylate, and hydroxypropyl and hydroxybutyl acrylates and methacrylates. The hydroxypropyl esters (in which the free hydroxy groups may be primary or secondary or a mixture thereof) have the advantage of relatively low cost. The epoxy comonomers, for example, glycidyl methacrylate, confer on the copolymer substantially stronger bonding to glass surfaces than does hydroxyethyl methacrylate. It may thus be possible to use smaller proportions of these comonomers than those of hydroxyethyl methacrylate, to achieve, for example, the required degree of adhesion to glass.

Bonding is effected in the normal manner according to which adhesive is used and the properties of the materials from which the edge strip and glazing material are made. If heat must be applied to bond the assembly together the material from which the edge strip and glazing sheet are made must be resistant to degradation and deformation at the temperatures employed. Adhesives produced from the ethylene copolymers specified above are bonded, after putting together the assembly, by heating the assembly at temperatures above about 110°C with an upper limit in the region of 180°C. For example, bonding may be effected at a temperature ranging from 120°C to 160°C, heating being maintained for up to about 60 minutes, preferably 10 to 30 minutes. Heating may be effected by exposing the assembly to a flame or placing it in an oven. When such ethylene copolymers are used it is preferred to make the edge strip from an extruded aluminium section, since this will withstand the heating process, which may conveniently consist of the application of a flame to the strip.

When the glazing material is glass, the adhesion between the glass and the adhesive material, particularly the aforesaid ethylene copolymers and polysulphides, may be improved by applying an adhesion promoting agent to the glass surfaces and/or the adhesive composition surfaces which are to be bonded together prior to assembling the sheet and plastics material.

The adhesion promoting agent is advantageously a compound having functional groups which will couple with a functional group of the adhesive composition and is also capable of forming linkage with the

glass surface. Silanes are our preferred adhesion promoting agents, particularly vinyl silanes, epoxy silanes, amino silanes, triethoxy silane and trimethoxy silanes such as vinyl trichlorosilane, x-aminopropyltriethoxy silane, vinyl triethoxy silane, methyl triethoxy silane, vinyl triacetoxysilane, ethyl-aminotrichlorosilane, a-glycidoxypentyltrimethoxy silane, methacryloxy silane, vinyl trimethoxy silane and methyl trimethoxy silane.

The adhesion promoting agent may be applied to the glass surface and/or in some circumstances the adhesive composition, e.g. when a bead or strip of the aforesaid ethylene copolymer is used, in the form of a solution which may consist of the undiluted adhesion promoting agent when it is a liquid or of the adhesion promoting agent in aqueous solution or dispersion or in an organic solvent, preferably one of low boiling point such as petroleum ether, toluene, benzene or xylene. Alternatively, when the adhesion promoting agent is readily vaporisable it may be applied to the glass surface and/or the adhesive material as a vapor.

In general, it is most convenient to use a liquid adhesion promoting agent, such as methyl triethoxy silane, and this may be applied by brushing, spraying or wiping the liquid over the surface to which it is to be applied.

Preferably both the surface of the glass and the adhesive material are wetted with the adhesion promoting agent. This may conveniently be accomplished by applying a coating of the adhesion promoting agent to the surface of the adhesive material only and then bringing the glass and coated adhesive material surfaces together whereupon the glass is wetted by the adhesion promoting agent. The assembly is then heated to produce the bond between the glass and the adhesive material.

It has been found that a satisfactory degree of adhesion between a glass surface and the adhesive material can be achieved when vinyl triethoxysilane is used as an adhesion promoting agent. This may be applied to the surfaces to be bonded in the manner described in the last preceding paragraph.

In order that the present invention may be more readily understood several preferred embodiments thereof are now described by way of example only and with reference to the drawings, of which Figures 1 and 2 accompany the Provisional Specification of Application No. 26322/68 and Figures 3, 4 and 5 accompany the present Complete Specification.

In the drawings:

Figure 1 is a partial cross-section of an assembly according to the invention

attached to a single-glazed window frame;

Figure 2 is a partial cross-section of an alternative assembly according to the invention attached to a single glazed window frame;

Figure 3 is a cross-section taken horizontally through an opening window frame and a fixed window frame on which an assembly according to the invention is mounted;

Figure 4 is an exploded perspective view of a hinge as shown in Figure 3; and

Figure 5 is a cross-section through a window showing an assembly according to the invention secured in the window surround.

Figure 1 shows an opening window frame having wooden side members 10 and 11 and which is glazed in a conventional manner with a single sheet of glass 12 retained in position by strips of putty 13 and 14. An assembly 16 according to the invention is mounted on the window frame to convert it to double glazing. The assembly 16 consists of a sheet of glass 17 and an edge strip 19 arranged around all four edges of the sheet of glass 17. The edge strip 19 has a base web 20 and a flange extending substantially perpendicular inwardly from the base web 20 and also longitudinally along the base web 20, and is formed as an extruded section of aluminium. The sheet of glass 17 is bonded to the flange 21 and the base web 20 by a fillet 22 of synthetic plastics adhesive material comprising by weight, ethylene 77.5%, hydroxyethyl methacrylate 14.5% and methyl methacrylate 8.0%.

The bonding process is carried out by firstly positioning the fillet 22 as an extruded profile, conforming to the surfaces of the base web 20 and the flange 21, in the angle between the base web 20 and the flange 21. Methyl triethoxysilane as an adhesion promoting agent is applied to the edge regions of the sheet 17 to be bonded to the fillet 22. The edge strip 19 together with the fillet 22 is located around the edges of the sheet 17 with the edge regions of the sheet 17 treated with adhesion promoting agent in contact with the fillet 22. The assembly is clamped together and heated in an oven to raise the temperature of the fillet 22 of adhesive material to about 140°C, thereby bonding the edges of the glass sheet 17 to the flange 21 and the base web 20 of the edge strip 19.

A foamed "Neoprene" sealing strip 23 is bonded by an adhesive comprising a chloroprene rubber in methylene chloride solvent to the edge strip 19 so that it confronts and is compressed between the assembly 16 and the frame.

One section of the edge strip 19 bonded along an edge of the sheet 17 is pivotally

mounted on the side member 10 of the frame by means of two nylon hinges 24. One leaf of each of the hinges 24 is affixed to the edge strip 19 after bonding the glass sheet 17 thereto by blind rivets 25. The other leaf of the hinge is affixed to the side member 10 by screws 26. The remaining three sides of the assembly are releasably secured to the frame, as shown in relation to the side member 11. A nylon snap clip 28 is attached to the side member 11 by a screw 29. When the assembly is fastened to the side member 10 the snap clips located on the remaining side members are deformed outwardly to permit the assembly to be moved into contact with the frame, for example, the clip 28 is moved to the right. When the assembly is in place the clips are allowed to return to their undeformed state as shown thereby engaging the peripheral surface of the glass sheet 17 holding the assembly in firm contact with the frame. The assembly 16 is mounted on the frame by means of the hinge 24 and the clips 28 so that the sealing strip 23 is compressed between the assembly 16 and the frame thereby sealing the space between the two sheets 12 and 17. To obtain a satisfactory seal the sealing strip has such a depth that it protrudes in its undeformed state beyond the edge of the base web 20 which confronts the frame. Mounting the assembly 16 on the frame then serves to compress the sealing strip 23 to produce a satisfactory seal.

Figure 2 shows an opening wooden window frame having side members 35 and 36 and provided with a conventional single-glazed system comprising a glass sheet 37 retained in position by strips of putty 38 and 39. An assembly 40 according to the invention is attached to the frame to convert the system to double glazing. This consists of an extruded aluminium strip 43 and a glass sheet 44. The edge strip 43 has a base web 45 and two spaced apart flanges 48 and 49, each extending substantially perpendicular inwardly from the base web 45 and both extending parallel to each other longitudinally along the base web 45. The glass sheet 44 is bonded into the space between the flanges 48 and 49 by means of a fillet 51 of synthetic plastics adhesive material comprising by weight ethylene 73.0%, hydroxyethyl methacrylate 23.0% and methyl methacrylate 4.0%.

Bonding of the glass sheet 44 into the space between the flanges 48 and 49 is carried out in a manner similar to that used for the embodiment shown in Figure 1. The fillet 51 was inserted into the space between the flanges 48 and 49 as an extruded profile. The edge of the glass sheet 44, after treatment with methyl triethoxy silane as an adhesion promoting agent, was

positioned in the space to contact the fillet 51 of adhesive material. The edge strip 43 was clamped to the glass sheet 44 and the clamped assembly heated in an oven to raise the temperature of the fillet 51 of adhesive composition to about 140°C thereby bonding the edges of the glass sheet 44 into the space between the flange 48 and 49.

A foamed "Neoprene" sealing strip 55 is bonded to the flange 49 and the adjacent part of the base web 45 of the edge strip 43 so that it is compressed between the flange 49 and the frame.

A section of the edge strip 43 bonded along one edge of the sheet 44 which corresponds to the side member 35 has a leaf 56 of each of two nylon hinges 57 blind rivetted to it whilst the other leaves 58 of the hinges 57 are screwed to the side member 35. This form of attachment enables the assembly 40 to be pivoted about the hinges.

The edge strips bonded to the remaining three sides are essentially similar to the strip 43, but, as shown for the edge strip 60, an outward ridge 61 is formed longitudinally along the base web 62 to enable the assembly to be firmly clamped against the frame by means of a nylon snap clip 63 screwed to the side member 36. The snap clip 63 functions in a similar manner to the snap clip 28 shown in Figure 1 by engaging the ridge 61 and the edge strip 60. The manner of mounting the assembly on the frame by means of the hinges 57 and the clips 63 serves to form an efficiently sealed space between the glass sheets 37 and 44 by compressing the sealing strip 55 between the flange 49 and the frame. The sealing strip 55 has a depth which protrudes beyond the edge of the base web 45 which confronts the frame so that compression of the sealing strip produces a good seal.

Figure 3 shows a cross-section taken horizontally through a window assembly. A fixed window frame has two vertical wooden side members 65 and 66 which are affixed directly in the window surround (not shown) of a building wall. An opening fanlight window consisting of wooden side members 67 and 68 with a single sheet of glass 69 is mounted in the fixed frame and hinges about an axis perpendicular to the side members 65 and 66. An assembly according to the invention is shown at 70. This comprises a sheet of glass 72 and an extruded aluminium edge strip 73 bonded around all of the edges of the glass sheet. The edge strip has a base web 74 and two spaced apart flanges 76 and 77 extending substantially perpendicular inwardly from the base web 74 and longitudinally along the base web. Each flange has an inwardly projecting rim 78 serving to position the

edge of the glass sheet in the strip 73. A small ridge 79 projects inwardly from each flange 76 and 77 serving to limit the extent to which the edge of the glass sheet 72 may project inside the strip 73, thereby providing space between the edge of the glass sheet 72 and the base web 74 to accommodate screws and rivets used to attach components to the base web 74. The edge of the glass sheet 72 is bonded between the flanges 76 and 77 by a synthetic plastics adhesive material comprising by weight, ethylene 77.5%, hydroxyethyl methacrylate 14.5% and methyl methacrylate 8.0%.

The assembly 70 is produced by positioning an extruded bead of the adhesive composition treated on its surface with methyl triethoxysilane adhesion promoting agent inside a length of the edge strip 73 sufficient to extend around the whole perimeter of the glass sheet 72. The edge strip 73 and the bead of adhesive material are heated to raise the temperature of the composition to about 160°C. The strip 73 is then located around the edges of the glass sheet 72 and the assembly clamped together whilst the composition is cooling to form a bond between the glass and the edge strip 73.

A foamed "Neoprene" sealing strip 81 is bonded by an adhesive formed from a chloroprene rubber in methylene chloride as solvent to the flange 77 and the section of the base web 74 between the flange 77 and the frame. The sealing strip 81 is slightly deeper than this section of the base web 74 so that it is compressed between the frame and the base web 74 thereby forming a seal between the frame and the assembly 70.

The assembly 70 is attached to the frame by hinges 82 and 83 screwed to the members 65 and 66 respectively. The hinges 82 and 83 have the construction shown in exploded form in Figure 4. The hinge is composed of two parts 85 and 86, each identical mouldings of nylon. The parts 85 and 86, as shown in part 86, have a base 87 from which two upstands 88 and 89 project, a space 90 corresponding to the length of the upstand 88 being located between the upstands 88 and 89 and a space 91 corresponding to the length of the upstand 89 being located between the upstand 88 and the end of the base 87. Aligned bores 92 and 93 having diameters corresponding to that of a pivot pin 94 extend through the upstands 88 and 89. The hinge may be assembled by reversing the parts 85 and 86 and bringing them together so that the upstands 95 and 96 on the part 85 are located in the spaces 91 and 90 respectively on the part 86. The pivot pin 94 is then inserted through the bores 92 and 93 and the corresponding bores 97 and 98 in the part 85 to lock the two parts together whilst permitting the parts to pivot about the

pin. Countersunk screw holes 99 are provided in the bases 87 of each of the parts for attaching the hinges to the assembly and to the frame.

The assembly is affixed to the fixed window frame by affixing the two separated parts of each hinge to the frame side members and to the assembly individually. In the embodiment shown in Figures 3 two hinges are attached to each of the side members 65 and 66, only the upper hinges 82 and 83 being visible. One part of each hinge is attached to the respective side member by driving screws through the holes 99 into the side member and the other part of the hinge is attached by riveting to the assembly in a position corresponding to that of the first part on the side member. The assembly is then positioned against the frame by inter-engaging the upstands and intervening spaces of the corresponding parts of each hinge and inserting the pivot pin through the bores in the upstands thereby locking the two parts together and also the assembly to the fixed window frame. The assembly may be opened to allow access to the fanlight for cleaning or to open it for ventilation by removing the pivot pins from the hinges attached to one side member, e.g. the hinge 82 and the hinge affixed to the member 65 below the hinge 82. Removal of the pivot pins permits the two parts of the hinges to be separated thereby allowing the assembly to pivot about the hinges attached to the side member 66 such as the hinge 83. The assembly may be removed altogether from the fixed window frame by withdrawing the pivot pins from all of the hinges thereby permitting the two parts of each hinge to be separated.

Figure 5 shows a brick surround 101 to a window aperture in which a fixed wooden frame 102 carrying a single glass sheet 103 is mounted. A strip 104 of rigid polyvinyl chloride is screwed by screws 105 to the surface of the surround 101 on the internal side of the window frame 102. An assembly 106 according to the invention and similar in construction to the assembly 70 shown in Figure 3 is secured to the strip 104 by hinges 107 having the construction shown in Figure 4. The assembly may be pivoted away from the frame by removing the pivot pins from the hinges along one side of the assembly and pivoting the assembly on the hinges along the facing side of the assembly.

Although Figure 5 shows the frame 102 as a fixed frame it is to be understood that this embodiment may be employed with a modification in which a single glazed opening window frame is mounted in a fixed frame which is secured in the window surround 101, i.e. the manner of mounting the assembly in Figure 5 may be used for a fixed or opening window.

Instead of mounting the assembly on the

strip 104 attached to the inside of the surround 101, the strips may be attached to the interior lateral surface 110 of the surround and the assembly 106 mounted on the strip 5 104.

WHAT WE CLAIM IS:—

1. An assembly for the conversion of a single-glazed window to double glazing or a single window to a double window, which 10 comprises an edge strip and a sheet of glazing material, said edge strip having a base web and a flange extending substantially perpendicularly out of and longitudinally along the base web, at least one marginal portion of the 15 sheet of glazing material being bonded to said flange and web.

2. An assembly according to claim 1, having a further flange spaced apart from the first flange and parallel thereto extending substantially perpendicularly out of and longitudinally along the base web, the marginal 20 portion of the sheet of glazing material being bonded into the space between the two flanges or to the web and outer surface of one of the flanges.

3. An assembly according to claim 1 or 2, in which the sheet of glazing material is glass; or a transparent or translucent vinyl chloride polymer or polymethyl methacrylate. 25

4. An assembly according to claim 1, 2 or 3, in which the edge strip is made of metal or a synthetic plastics material.

5. An assembly according to claim 4, in which the metal is aluminium or stainless steel. 30

6. An assembly according to claim 5, in which the edge strip is an extruded aluminium section.

7. An assembly according to claim 4, in which the synthetic plastics material is a glass reinforced polyester resin, nylon, glass reinforced nylon, a vinyl chloride polymer, a polyacetal or polymethyl methacrylate. 40

8. An assembly according to any preceding claim, in which the sheet of glazing material is bonded to the edge strip by an adhesive material comprising polyvinyl butyral, a polysulphide, a polyacetal or an epoxy resin. 50

9. An assembly according to any of claims 1 to 7, in which the sheet of glazing material is bonded to the edge strip by an adhesive material comprising a copolymer of ethylene with one or more hydroxy or epoxy lower aliphatic monoesters of acrylic acid or methacrylic acid, and with from 0% to 55% of at least one further comonomer, which is an ester of acrylic acid or methacrylic acid or a vinyl ester or another copolymerisable compound, said copolymer containing, by weight, at least 35% of ethylene and: 60

(a) from 1.0% to 8.5% of free hydroxy groups; or

65 (b) from 0.10% to 3.0% of oxygen; or

(c) both free hydroxy groups up to 8.5% and epoxy oxygen up to 3.0% provided that: Weight of free hydroxy groups + (10 × weight of epoxy oxygen) is always at least 1% by weight of the copolymer 70

10. An assembly according to claim 9, in which the copolymer contains 1.5% to 6.0%, of free hydroxy groups and/or from 0.3% to 1.0%, by weight, of epoxy oxygen.

11. An assembly according to claim 9 or 10, in which the further comonomer comprises styrene, vinyl acetate or an alkyl ester of acrylic or methacrylic acid. 75

12. An assembly according to claim 11, in which the comonomer comprises methyl methacrylate. 80

13. An assembly according to any of claims 9 to 12, in which the adhesive material comprises the terpolymer of 77.5% by weight of ethylene, 14.5% by weight of hydroxyethyl methacrylate and 8.0% by weight of methyl methacrylate. 85

14. An assembly according to any of claims 9 to 12, in which the adhesive material comprises the terpolymer of 73.0% by weight of ethylene, 23% by weight of hydroxyethyl methacrylate and 4.0% by weight of methyl methacrylate. 90

15. An assembly according to any preceding claim, in which the sheet of glazing material and/or the adhesive material used to bond the sheet of glazing material and the edge strip together are or is treated with an adhesion promoting agent. 95

16. An assembly according to claim 15, in which the adhesion promoting agent comprises vinyl trichlorosilane, γ -aminopropyl triethoxy silane, vinyl triethoxy silane, methyl triethoxy silane, vinyl triacetoxysilane, ethyl-aminotrichlorosilane, α -glycidoxypolytrimethoxy, vinyl trimethoxy silane, methyl trimethoxy silane, or methacryloxy silane. 100

17. An assembly according to any preceding claim, which includes a sealing strip arranged to prevent the passage of air between the assembly and the window component to which the assembly is attached. 105

18. An assembly according to claim 17, in which the sealing strip is made from a foamed plastics material, a rubber, a foamed rubber or a woven fabric pile. 110

19. An assembly according to any preceding claim, in which the edge strip has an outwardly facing ridge which may be engaged by a clip to clamp the assembly to the window component to which it is attached. 115

20. An assembly according to any preceding claim in which the or each flange has an inwardly projecting rim serving to position the sheet of glass material with respect to the edge strip. 120

21. An assembly according to claim 2 or any of claims 3 to 20 as appendant to claim 2, in which a ridge projects inwardly from 125

- each flange to limit the extent to which the edge of the sheet of glazing material projects into the space between the flanges.
22. An assembly for the conversion of a
5 single-glazed window to double glazing substantially as hereinbefore described with reference to and as shown in Figure 1 or 2 of the drawings.
23. An assembly for the conversion of a
10 single window to a double window substantially as hereinbefore described with reference to and as shown in Figures 3 and 4 or Figure 5 of the drawings.
24. A double glazed unit converted
15 from a single glazing unit in which an assembly according to any of claims 1 to 19 or claim 22 is affixed over the existing glazing of a single glazed window.
25. A double glazed unit according to
20 claim 24 in which the assembly is attached to the frame of the single glazed window to form a sealed space therebetween.
26. A double glazed unit according to
25 claim 24, in which the assembly is detachably affixed to the frame of the single glazed window.
27. A double glazed unit according to
30 claim 26, in which the attachment to the frame of all of the sides of the assembly except for one can be released from the frame, the remaining side being hinged to the frame.
28. A double glazed unit according to
35 claim 27, in which the sides of the assembly which are releasable from the frame are secured to the frame by clips.
29. A double glazed unit according to
40 claim 28, in which the clips are snap clips.
30. A double glazed unit according to any
45 of claims 24 to 29, in which an edge bead is clamped around the periphery of the assembly to affix the assembly over the single glazed windows.
31. A double glazed unit according to
50 claim 30, in which the edge bead is formed as a hinge and can also be separated into two parts whereby the assembly can be hinged away from the frame of the single glazed window, to which the assembly is attached, by the edge bead attached to one of the sides
55 of the assembly after the edge bead attached to the other sides of the assembly has been separated into two parts.
32. A double glazed unit converted from
single glazing to double glazing, in which
an assembly according to claim 20, 21 or 23
is affixed over the existing glazing of a single
glazed window.
33. A double glazed unit according to
60 any of claims 24 to 32, in which the assembly is affixed over a fixed or opening window frame.
34. A double window in which an assembly according to any one of claims 1-19 is affixed to the fixed frame in which
65 an opening window frame is mounted.
35. A double window in which an assembly according to any one of claims 1-19 is affixed to the window surround in which
70 the single-glazed window is mounted.
36. A double window according to claim 35, in which the assembly is mounted on a mounting strip provided in the surround.
37. A double glazed unit according to
75 claim 24 or 32, in which the assembly is permanently affixed to an opening window frame, or to a fixed window frame which does not carry an opening window frame.
38. A double window according to claim 34, in which the assembly is pivotable away
80 from the fixed frame to enable the opening frame to be opened.
39. A double glazed unit according to
85 claim 33, in which the assembly is detachably affixed to the fixed or opening window frame.
40. A double glazed unit according to
90 claim 39, in which the attachment to the fixed or opening frame of all of the sides of the assembly except for one can be released from the fixed or opening frame, the remaining side being hinged to the fixed or opening frame.
41. A double glazed unit according to
95 claim 40, in which the sides of the assembly which are releasable from the fixed or opening frame are secured to the fixed or opening frame by clips.
42. A double glazed unit according to
claim 40, in which the clips are snap clips.
43. A double glazed unit according to
100 claim 39 or 40, in which the assembly is affixed to the fixed or opening window frame by means of hinges attached to opposite sides of the assembly, each hinge being separable into two parts by withdrawing the pivot pin,
105 one part of the hinge being secured to the assembly and the other part to the fixed or opening frame.
44. A double glazed unit converted from
110 single glazing to double glazing, substantially as hereinbefore described with reference to and as shown in Figure 1 or 2 of the drawings.
45. A double window converted from a
115 single window to a double window, substantially as hereinbefore described with reference to and as shown in Figures 3 and 4 or Figure 5.

C. GRATWICK,
Agent for the Applicants.

1,264,307
1 SHEET

PROVISIONAL SPECIFICATION

*This drawing is a reproduction of
the Original on a reduced scale.*

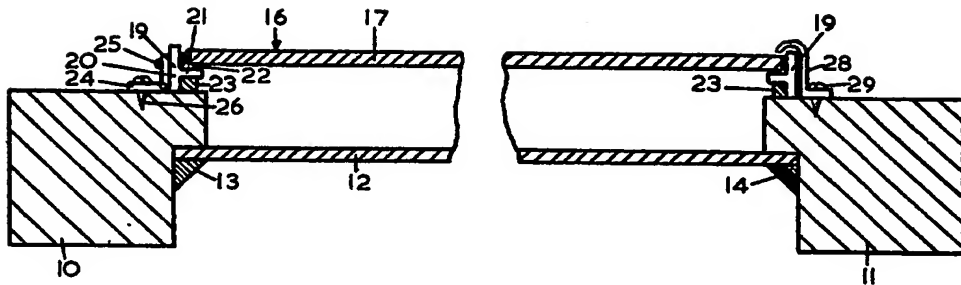


FIG 1

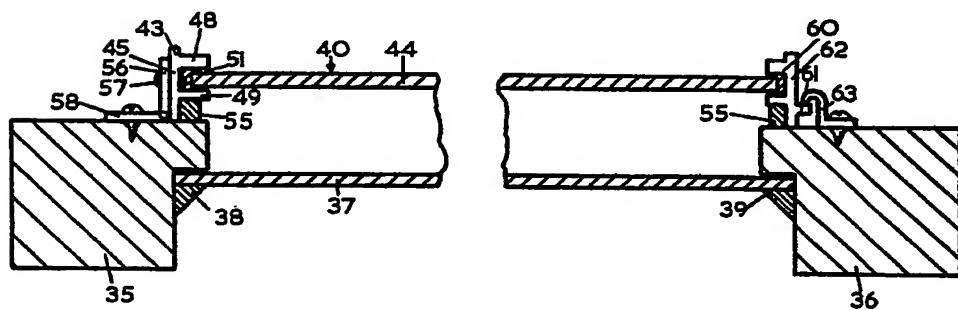


FIG 2

1,264,307 COMPLETE SPECIFICATION
 2 SHEETS
 This drawing is a reproduction of
 the Original on a reduced scale.
 SHEET 1

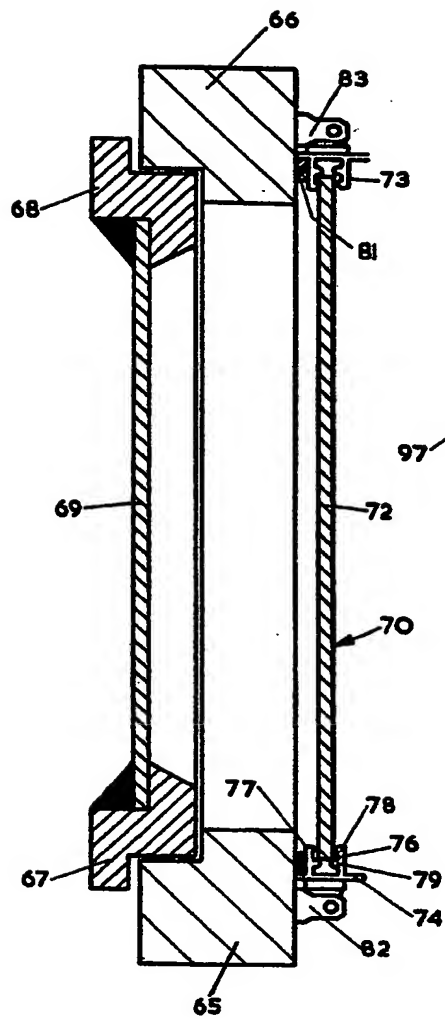


FIG. 3

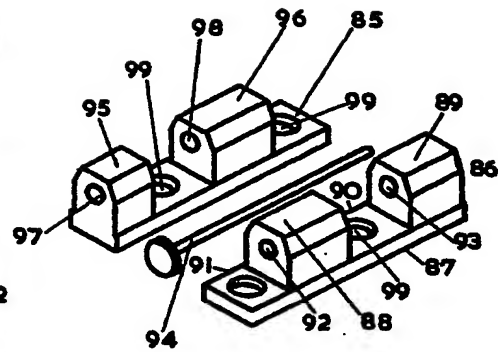


FIG. 4

